DOCUMENT RESUME

ED 264 935 PS 015 272

AUTHOR Daugherty, Thomas; And Others
TITLE Using Computers to Construct Knowledge and Enhance Teacher-Child Interactions.
PUB DATE 8 Jun 85
NOTE 31p.; Paper presented at the Annual Symposium of the Jean Piaget Society (15th, Philadelphia, PA, June 6-8, 1985).
PUB TYPE Viewpoints (120) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Cognitive Processes; Elementary Education; *Elementary School Students; *Elementary School Teachers; *Microcomputers; *Teaching Methods; *Teaching Skills
IDENTIFIERS *Computer Uses in Education; Teacher Competencies

ABSTRACT

Although inappropriate computer experiences emphasizing things more than people are frequently introduced into elementary school classrooms by inadequately trained administrators and teachers, computers can be appropriately used to liberate or empower thinking abilities. Certainly, computers should be used for specific reasons, but "appropriate" should be understood as a metaphor for emerging "good" teaching methodologies and adaptation of class content. When teachers begin to learn to use new programs in their classrooms, they reveal themselves as learners. Thus, students have the opportunity to learn with a learning adult. When learning is the model for what adults do in the classroom, then the computer provides a richness of possibilities; in the student-technology-teacher relationship, a unique opportunity implicitly exists. Computers are not teacher-remedial, nor should they be intrusive. Computer use should be internalized by the teacher and the classroom dynamics into an already-excellent pedagogy. In essence, appropriate computer use should be viewed as a methodological hybrid, seen as an important media only when and where it offers significant instructional experiences. Teachers should have the time, in-service experience, and the security within the school system to use the computer to create a milieu in which students become hypothesis-testers with critical thinking abilities, and not fixed reality constructions. Appended materials illustrate the use of the computer to facilitate thought and describe various appropriate uses. (RH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

ED264935

USING COMPUTERS TO CONSTRUCT KNOWLEDGE AND ENHANCE TEACHER-CHILD INTERACTIONS

PRESENTATION AT THE FIFTEENTH ANNUAL SYMPOSIUM OF THE JEAN PIAGET SOCIETY

"CONSTRUCTIVISM IN THE COMPUTER AGE"

JUNE 8, 1985 IN PHILADELPHIA

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Thomas Daugherty
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

THOMAS DAUGHERTY
ANNETTE PAPARELLO
REBA PEKALA
OF THE COGNITIVE LEVELS MATCHING PROJECT
SHOREHAM-WADING RIVER CENTRAL SCHOOLS
SHOREHAM, L.I., NEW YORK

PS 015272

HIGH TECH CATCH 22

SINCE SCHOOLS REFLECT THE CONFUSION TOWARD THE ROLE OF COMPUTERS THAT IS EVIDENT IN SOCIETY IN GENERAL, ONE WONDERS ABOUT A HIGH-TECH CATCH 22 (KOMOSKI, 1984), WITH EDUCATORS WONDERING WHETHER TO ADOPT THE BURDEN OF EDUCATIONAL COMPUTING AND ITS POTENTIAL (RISKS AND BENEFITS) IN AN"...ILL-PREPARED, UNDERSTAFFED, AND UNDERFUNDED..." MILIEU, OR NOT MAKING THE COMMITMENT, ALLOWING A GREAT POTENTIAL TO GO UNREALIZED AND THEN FACING CRITICISM FOR FAILING TO PREPARE STUDENTS.

Computer Microworlds and Thinking

It is suggested that thinking, metacognition, critical thinking, etc. not be separate courses of study, but that they are the matrix in which is embedded a Kindergarten - 12 agreement and philosophy that reasoning, autonomy, thinking and decision making are why schools (should) exist. It is further suggested that the micro-worlds that children generate via computers are as complex, fanciful, yet appropriate as the micro-worlds of previous generations.

"EARLIER + FASTER = BETTER" FALLACY

APPROPRIATE COMPUTER USE IS CONSISTENT WITH ...(T)HE WORLD OF CHILDHOOD, ENVIRONMENT AND TEACHER, ... FILLED WITH MOVEMENTS, PATTERNS, EMOTIONS, IMAGES, AND ACTIONS THAT, WHEN TRANSFORMED, SHOULD UNDERLIE ADULT INTELLECTUAL, EMOTIONAL AND MORAL LIFE" (ZAJONC, 1984). IT IS NOT SUGGESTED THAT COMPUTERS WILL "BUY INTO" THE CURRENT MISTAKE OF EARLIER + FASTER = BETTER.

NORM REFERENCING AND THE LOWEST COMMON DENOMINATOR

THE MICROCOMPUTER IN THE ELEMENTARY CLASSROOM IS A THOUGHT-ENHANCER WHEN THE TEACHER AND ADMINISTRATOR CHOOSE A COURSE OF ACTION FOR THE "RIGHT" REASONS RATHER THAN BY DEFAULT ("LOOK, THE BOARD SAYS WE'VE GOT TO GET COMPUTERS AND SOFTWARE INTO KID'S HANDS. BUY THESE PACKAGES.").

IN ITS MOST BASIC USE, THE COMPUTER RECALLS, CALCULATES, LISTS AND "COMPUTES". IT SEEMS THAT IN A SCHOOL SYSTEM IN WHICH THE VERY SAME TYPE OF "ACHIEVEMENT" IS MOST HIGHLY-REGARDED, CHILDREN MAY BEGIN TO BEEN SEEN AS PRODUCTS, THE SUM OF THEIR SKILL ACQUISITION PARTS. TEACHER EXPECTATIONS AND METHODS FOLLOW, ACCORDINGLY.

OPPORTUNITIES TO IMPROVE THINKING IN THE CLASSROOM

* ENHANCEMENT OF INTELLECTUAL AUTONOMY
* EMPOWERING OF INDEPENDENT RISK OR INITIATIVE TAKERS
* PREPARE STUDENTS TO EDUCATE SELVES
* ENGAGE STRATEGIES/COLLECTIVELY PROBLEM SOLVE
* LIBERATE THOUGHT (COMPUTERS ARE NON-LINEAR)
* PROVIDE CONTEXTS FOR DIFFERENT LEVELS
* EXTENSION OF PROBLEM SOLVING (STUDENTS CONSTRUCT ALGORITHMS AS A MEANS)
* MANIPULATE ORGANIZATION/PERSPECTIVES
* ALLOW STRATEGIES TO EVOLVE

Computers in a Constructivist Context (continued)

Teacher Methodologies

* ALLOW TEACHERS TO REVEAL SELF AS LEARNER
* ALLOW CHILDREN TO PARTICIPATE WITH THE ADULT/LEARNER AS COLLEAGUE
* FOLLOW MODEL OF LEARNING, NOT TEACHING
* HYBRID OF ALREADY - EXCELLENT METHODS (NOT TEACHER REMEDIAL OR INTRUSIVE)
* DEEMPHASIZE NORM-REFERENCED TESTING
* PROVIDE A METAPHOR FOR GOOD TEACHING, EVEN IN A NON-TECHNICAL CONTEXT

Social Context

* HIGHLIGHT AN AWARENESS OF CHANGE
* ENHANCEMENT, IN ACTIVITIES, OF HUMAN CONTACT (SOCIAL CONTEXT)
* NON-JUDGEMENTAL

AN INFORMATION PROCESSING MODEL INSTEAD OF A CHILD DEVELOPMENT PERSPECTIVE!

"...(S)EVEN EXPERIENCED COMPUTER USING EDUCATORS.." EVALUATED 100 NEW PROGRAMS (ELECTRONIC LEARNING, 1985)

ALPHABOTS
GRADE LEVEL: PRE-SCHOOL - KINDERGARTEN
HARDWARE: APPLE II FAMILY (48K)
PUBLISHER: DCH
PRICE: $45.00
NOT RECOMMENDED: THIS "KEYBOARD SKILLS" PROGRAM NEVER TEACHES THE CORRECT FINGERING POSITION.
DESCRIPTION: ACTIVITIES DESIGNED TO BUILD KEYBOARD FAMILIARITY AND COORDINATION SKILLS.

INSTEAD OF CRITICIZING THE VALIDITY OF "TEACHING" PRE-SCHOOLERS KEYBOARDING, THE REVIEWER IS MORE INTERESTED IN THE "CORRECT FINGERING POSITION".

INAPPROPRIATE SOFTWARE DECISIONS

PUNCTUATION SKILLS

GRADE: LEVEL: 5-12
HARDWARE: IBM PC/PC JR./XT/AT (128K)
PUBLISHER: IBM CORP.
PRICE: $46.00

RECOMMENDED: PLENTY OF FEEDBACK AND LOTS OF INTERACTION
DESCRIPTION: PROVIDES PRACTICE AND REVIEW OF THE BASIC RULES OF PUNCTION.

COMMENTS: THERE ARE A VARIETY OF STANDARDIZED TEST FORMATS USED AND A SUMMARY OF RIGHT AND WRONG ANSWERS IS GIVEN AFTER EACH. THE PROGRAM NEEDS A MANAGEMENT SYSTEM IF IT IS TO PROVIDE USEFUL DIAGNOSTIC INFORMATION.

THIS PROGRAM PROVIDES "...LOTS OF INTERACTION?" CERTAINLY NOT IN A CONSTRUCTIVIST PERSPECTIVE. A VARIETY OF STANDARDIZED TESTS IN A PRACTICE OF PUNCTION DOES NOT SEEM TO LIBERATE THE THINKER AND IT IS CLEARLY ONLY A MEDIOCRE APPLICATION OF THE COMPUTER.

ADMINISTRATIVE PERSPECTIVE

THE COMPUTER IS NOT INTERVENTION; IT IS USED TO LIBERATE AND ELABORATE (TURKLE, 1984).

RECENTLY, A CENTRAL OFFICE ADMINISTRATOR, INTERESTED TO DETERMINE WHETHER COMPUTERS WERE BEING USED "APPROPRIATELY", ASKED AN ELEMENTARY PRINCIPAL TO WALK WITH HER THROUGH THE BUILDING TO OBSERVE INSTANCES OF COMPUTER USE. THEY COULD FIND NONE OF THE MANY COMPUTERS IN USE AT THE TIME. THERE WAS A CONCERN VOICED THAT THE COMPUTERS WERE GATHERING DUST. THERE WAS, HOWEVER, ALSO THE OPPOSITE CONCLUSION THAT, IN THIS CASE, DISUSE WAS A GOOD SIGN: TEACHERS DID NOT FEEL COMPELLED TO USE THE COMPUTOR SIMPLY BECAUSE IT WAS THERE, IT WAS EXPENSIVE AND IT WAS TRENDY. UPON QUESTIONING INDIVIDUAL TEACHERS, THE MOST COMMON RESPONSE WAS, "OH, YES, WE'RE USING IT LATER WHEN I CAN SIT DOWN AND WORK TOGETHER WITH THE CHILDREN". TEACHERS WERE MODELS OF THINKING PERSONS (FURTH AND WACHS, 1974).

TEACHERS IN CONTROL OF DECISIONS ABOUT COMPUTERS

AN ILLUSTRATION OF THE ACTIVE INQUIRY THAT OCCURS WHEN TEACHERS FEEL IN CONTROL OF COMPUTERS, EMPOWERED BY EMERGING EXPERTISE.

TEACHERS ADAPT DISKS FOR USES NOT INTENDED BY THE AUTHOR. AN EXAMPLE CAN BE SEEN IN THE DIALOGUE OCCURRING DURING THE DEMONSTRATION OF A CONSTRUCTION SET DISK, JUST IMAGINE, AT A K-3 FACULTY MEETING. THE PROGRAM HAS A NUMBER OF CHARACTERS, SOME STATIONERY, SOME MOBILE, WHO CAN BE SUPERIMPOSED OVER SEVERAL SCENES (E.G.: THE DESERT, A CITY AT NIGHT, ETC.). THE CHARACTERS CAN THEN BE PROGRAMMED TO MAKE CERTAIN MOVEMENTS. A STORY CAN BE TYPED IN AND IT CAN BE MADE INTO A MOVING ILLUSTRATION BY THE CHILD. IT IS NOT UNCOMMON FOR THE NOVICE INSTRUCTIONAL COMPUTER USER TO VIEW A PROGRAM CONSIDERED TO BE QUITE ADVANCED BY THOSE WHO ARE EXPERIENCED AT THE COMPUTER, AS "PRIMITIVE" BECAUSE OF LIMITED RANGE OF MOTION OF CHARACTERS, OBTUSE SELECTION OF SEQUENCE AND RELATIVE LACK OF SOPHISTICATION OF THE GRAPHICS WE HAVE BECOME USED TO IN MOVIES SUCH AS "STAR WARS". WHEN THE DISK WAS PREVIEWED, TEACHERS ATTEMPTED TO ASSIMILATE THIS NEW INFORMATION INTO EXISTING METHODS AND FRAMES OF REFERENCE. ASIDE FROM THE "GIDDINESS" WHEN A COLLEAGUE HAS TO MAKE CHOICES/VALUE JUDGMENTS IN FRONT OF PEERS, THERE BEGAN TO EMERGE "WHAT WOULD I DO WITH THIS DISK?" STRATEGIES.

INSTEAD, TEACHERS SHOULD HAVE THE TIME, IN-SERVICE EXPERIENCE AND THE SECURITY WITHIN THE SYSTEM TO BE PRO-ACTIVE.

APPLICATIONS IN ELEMENTARY SPECIAL EDUCATION

A KINDERGARTEN AGE CHILD WITH CEREBRAL PALSY WAS MAINSTREAMED INTO A REGULAR SCHOOL ENVIRONMENT (WITH SUPPORTIVE SERVICES). WHILE IN THE RESOURCE ROOM, IT WAS NOTED THAT THIS NON-VERBAL, NON-AMBULATORY CHILD HAD PULLED HIMSELF UP IN FRONT OF A LARGE SCREEN MONITOR AND WAS BEING "TAUGHT" A PROGRAM BY A NEUROLOGICALLY IMPAIRED, LEGALLY BLIND 2ND GRADER. THE OLDER CHILD WAS HEARD TO SAY, "OK KEVIN, YOUR FINGERS ARE TOO WOBBLY FOR THE COMPUTER. YOU TOUCH THE SCREEN AND I'LL PUSH THE BUTTON." THE COMPUTER PROVIDED A SUCCESSFUL MEDIUM FOR THE 2ND GRADER TO "SHOW OFF" HIS TALENTS. IT ALSO GENERATED ENOUGH INTEREST FOR THE YOUNGER CHILD TO BE INTERESTED. "SOCIAL INTERACTION IS AN EFFECTIVE WAY OF EXPANDING YOUR UNDERSTANDING" (LABINOWICZ, 1985).

TEACHER EXPECTATIONS/QUESTIONS CHILDREN ASK THEMSELVES

AFTER THE CHILDREN EXPERIMENTED WITH LOGO USING THE TURTLE TO MAKE MAZES AND GIANT LINEAR ART FORMATIONS, I INTRODUCED A WAY FOR THEM TO CONSTRUCT A SQUARE. INSTEAD OF "MODERN" ART, THEY WOULD BE ABLE TO "MAKE" AN OBJECT ON THE SCREEN. LESS THAN AN HOUR LATER, A BOY IN MY LOWEST READINESS GROUP WAS CONSTRUCTING A SAILBOAT ---- RUDDER AND ALL!

LOGO Transformation

A 1st grade teacher introduced the LOGO subroutine for a circle which she had to curve in the right direction. "Mrs. Pekala look, I made a pair of glasses!" said one of my first graders. He had changed the appropriate right turn into a left turn and then connected the two circles. Soon the children were creating circles of varing sizes and putting circles into other circles! The child(ren) transformed the tedious into a means of demonstrating exploration and "success" and, in the meantime, revealing knowledge organization to the teacher.

CHILDREN REVEALING MENTAL CONSTRUCTIONS

BEFORE INTRODUCING LOGO TO MY FIRST GRADERS, I DID ALL THE APPROPRIATE READINESS SKILLS WITH THEM, SUCH AS DISCUSSING AND ACTING OUT THE MANY TURNING FEATURES OF THE TURTLE. I MADE A LARGE CHART SHOWING COMMANDS TO MOVE TURTLE AND I ADDED THE COMMANDS FOR CHANGING THE BACKGROUND AND PEN COLORS. MY INTENTION WOULD BE LIKE GIVING MY STUDENTS MAGIC MARKERS TO ADD "FLAVOR" TO THEIR SCREEN IMAGES!

TO MY SURPRISE, THESE SIX YEAR OLDS RARELY CHANGED THE COLORS, PREFERRING TO SPEND THEIR TIME GIVING THE TURTLE VARIOUS ANGLES TO TRAVEL AND WRAPPING IT AROUND THE SCREEN. ARTISTIC VISUAL IMAGES WERE MUCH MORE IMPORTANT TO THEM. TO VISUALLY HIDE TURTLE AMONGST ITS TRAILS WAS THE "BIG THRILL".

AUTONOMOUS RULE GENERATION

WE SHOULD NOT SEEK"...(T)HE COMPUTER WAY OF THINKING (THAT) CAN THEREBY COME TO '...INHABIT THE YOUNG MIND... PROVIDING A HEAD START IN COPING WITH THE ADULT WORLD" (DAVY, 1984). THE COMPUTER AND THE THINKER ARE, HOWEVER, NOT INCONSISTENT. IN FACT, APPROPRIATE COMPUTER USE CAN LIBERATE OR EMPOWER THE INDIVIDUAL TO THINK.

MIKE AND ED ARE THIRD GRADERS. HAVING SPENT SEVERAL DAYS, AT VARIOUS TIMES IN THE CLASSROOM CONTEXT, ON AN INTERESTING DISK, IN WHICH THE CHILD CONSTRUCTS TOOLS BY ROTATING "METAL", PUNCHING HOLES IN IT, CHANGING ITS SIZE AND OTHER CHARACTERISTICS (RISING ATTRIBUTES TO MAKE DECISIONS AND PREDICT OUTCOMES), THEY CAME INTO THE CLASSROOM BEFORE SCHOOL ONE MORNING. THEY SAID TO THE TEACHER, "WE CALLED EACH OTHER LAST NIGHT AND THINK WE'VE FIGURED OUT HOW TO GET THE MACHINES TO MAKE THE TOOL BY SKIPPING AND CHANGING SOME OF THE DIRECTIONS (COMPUTER ALGORITHMS). WE WANT TO TRY THEM OUT AND SEE IF WE'RE RIGHT."

MORAL VALUES

A MUSIC TEACHER BEGAN USING A COMPUTER MUSIC PROGRAM WHICH ALLOWED HIM TO MANIPULATE MUSIC PHRASES. HE BEGAN BY MANIPULATING OUR NATIONAL ANTHEM. HE REALIZED THAT CHILDREN WERE CREATING NEW MUSICAL ANTHEMS. CHILDREN WERE ENCOURAGED TO DESIGN NEW FLAGS FOR THESE "PRETEND" COUNTRIES. THE NEXT STEP WAS TO DISCUSS AND DESIGN MORAL VALUES - I.E., CONSTITUTIONS, ETC. FOR THESE "NEW" NATIONS BASED ON "ADAPTED" U. S. TRAITS.

COMPUTER USED AS MEDIATOR

WHEN DEMONSTRATING DECTALK (A COMPUTER VOICE SYNTHESIZER) TO MY ENGLISH AS A SECOND LANGUAGE STUDENTS THEY WERE IMMEDIATELY ABLE TO GENERATE APPLICATIONS. ONE NOTABLE USE OCCURRED WHEN THEY STARTED DEVELOPING DIALOGUE TO HELP ONE OF THE CLASS MEMBERS WORK THROUGH AN INTER-PERSONAL PROBLEM THEY ALL KNEW ABOUT.

WORD PROCESSING

In speaking with a man involved with educational computing for 15 years we began discussing how to pick a word-processing program. He said he advised a very simple program so that English teachers don't spend more time teaching word-processing than they spend teaching writing. I explained that I don't teach word-processing, but rather that I design lessons which encourage students to take advantage of specific powers of a program. For example, when trying to dynamically show the power of verb tense I ask students to take a previously written passage which was written in the present tense and change it using past tense. Demonstrating global search and replace makes this a realistic assignment. My colleague was able to note that my attitude was the result of perceiving the computer as a manipulator of organization. This inductive approach to word-processing puts the "thinker" ahead of the technician.

Appropriate Computer Use To Empower Thinkers

Appear in: Impact, the Journal of the N.Y. State A.S.C.D., 1985.

by Thomas Daugherty

Sherry Turkle's insightful book, The Second Self, has as its subtitle, Computers and the Human Spirit. This linkage between technology and the qualities of humanity may appear to be bold, and possibly contrived. In fact, it can be argued that many people believe that an inverse correlation may actually exist: as the use of technology increases, the flower of the human spirit will begin to wither. The popular misperception that Hal from 2001, the regimental soma society of Brave New World, and popular television programs showing unidimensional whiz kids using home microcomputers to solve crimes that befuddle adults, represent the world toward which we are moving (being drug). These views are highlighted by the faulty assumption exhibited when schools choose (are coerced) to purchase microcomputers. Since schools reflect the confusion toward the role of computers that is evident in society in general, one wonders about the high tech "Catch 22" (Komoski, 1984), with educators wondering whether to adopt the burden of educational computing and its potential (risk and benefits) in an "...ill-prepared, understaffed, and underfunded..." milieu, or not making the commitment, allowing a great potential to go unrealized and then facing criticism for failing to prepare students.

The untrained (and unnerved) administrator or teacher whose job it is to "implement a computer program" often resorts to actually supporting inappropriate computer usage derived from the above stereotypic misconceptions: packaged Computer-Assisted Instruction, keyboarding classes and programming courses at the early elementary school level, computer labs (seemingly quite cost effective) in primary schools, etc. These examples of inappropriate computer use are not devoid of merit per se; they are, instead, examples of a superficial "more form than substance approach" that emphasizes things (expensive looking hardware and glitzy programs) more than people. Of course, keyboarding has a time and place, as does CAI.

A recent trade magazine reviewed 100 new programs. The following represents the confusion that even "... seven experienced computer using educators ..." (Burroughs, 1985) can exhibit when goals are not set and when a child development perspective buys into an information processing model.

A L P H A B O T S
Grade Level: Pre-School - Kindergarten
Hardware: Apple II Family (48K)
Publisher: DCH
Price: $45.00
Not Recommended: This "keyboard skills" program never teaches the correct fingering position.
Description: Activities designed to build keyboard familiarity and coordination skills.

Instead of criticizing the validity of "teaching" pre-schoolers keyboarding, the reviewer is more interested in the "correct fingering position". This is evidently an example of the tail wagging the dog.

The following disk evaluation illustrated a reason not to choose a computer:

P U N C T U A T I O N S K I L L S
Grade: Level: 5-12
Hardware: IBM PC/PC jr./XT/AT (128K)
Publisher: IBM Corp.
Price: $46.00
Recommended: Plenty of feedback and lots of interaction.
Description: Provides practice and review of the basic rules of punction.
Comments: There are a variety of standardized test formats used and a summary of right and wrong answers is given after each. The program needs a management system if it is to provide useful diagnstic information.

This program provides "... lots of interaction?" Certainly not in a constructivist perspective. A variety of standardized tests in a practice of punctuation does not seem to liberate the thinker and it is clearly only a mediocre application of the computer.

The problem seems to be that computer decision-makers have, generally, chosen to go with the technological over the personal. The overriding reason for teacher avoidance of computer use is a lack of preparation and training. To date, most pre-service, as well as in-service coursework, has been inadequate (Diem, 1981). Typically, we see the teachers introduction to computer use in a series of canned coursework (programming, keyboarding, math enrichment via the "electronic worksheet" model). This approach is, perhaps, the worst example of the "bottom-line" philosophy. It may, in fact, be the ultimate educational example of norm-referencing. The tendency, in education, to be comfortable with the quantifiable is feeding into the pre-packaged program in which second graders must solve $7 + \square = 13$. The "safe" approach (CAI, programmed courses, etc.) may currently account for 90 percent of the microcomputer use in our schools (with 5 percent for "management" and, perhaps, 5 percent that is not readily quantifiable using an empirical metaphor). It is this latter 5 percent that this paper seeks to explore further. In fact, an attempt will be made to present a case for the computer as an effective, "powerful" (Papert, 1980) tool to encourage, enhance and elaborate on the processes of thinking. We will explore the definition of appropriate computer use. This paper will look at how and why educators must initiate and determine the application of these new and powerful technologies while mindful of the perspectives of child development.

The term, (critical) thinking is quite popular today. It appears in the foreward of nearly all state responses to A Nation At Risk. Unfortunately, the notions implicit in critical thinking are not enhanced to the standard State Education Department's reactive emphasis on increased evaluation, norm-referencing and "tightening of standards". Critical thinking, perhaps like the Bible, is

difficult to definitively interpret or identify to everyone's satisfaction. The concept is open to numerous personal interpretations which seem to run the gamut from CAI to metaphysics. It, therefore, becomes important for each individual, publishing company, and school system to define thinking at the outset in order to frame a context for instruction. There are, literally, dozens of "programs" and projects which suggest that they identify the aspects of thought. The issues of whether or not thinking can be taught, if there can be such a thing as a critical thinking skills curriculum, whether there are readily - identifiable incremental thinking subskills, what are the methods of teaching (for) thinking, whether critical thinking may be dysfunctional in light of recent state-wide testing emphasis, etc., are in the forefront of what we, as educators, ought to be considering. It is stated above that schools should identify thinking; this is intended to be considered in the context of the "how-to's" not the "what's" of thinking. It is suggested that thinking, metacognititon, critical thinking, etc. not be separate causes of study, but that they are the matrix in which is embedded a Kindergarten - 12 agreement and philosophy that reasoning, autonomy, thinking and decision making are why schools (should) exist.

In its most basic use, the computer recalls, calculates, lists and "computes". It seems that in a school system in which the very same type of "achievement" is most highly-regarded, children may begin to be seen as products, the sum of their skill acquisition parts. Teacher expectations and methods follow, accordingly. Appropriate computer use is consistent with "... (T)he world of childhood, environment and teacher, ... filled with movements, patterns, emotions, images, and actions that, when transformed, should underlie adult intellectual, emotional, and moral life" (Zajonc, 1984). This is <u>not</u> a suggestion

of the equation of earlier + faster = better. We should not seek "...(T)he computer way of thinking (that) can thereby come to '...inhabit the young mind...' providing a head start in coping with the adult world" (Davy, 1984). The computer and the thinker are, however, not inconsistent. In fact, appropriate computer use can liberate or empower the individual to think.

> Mike and Ed are third graders. Having spent several days, at various times in the classroom context, on an interesting disk, in which the child constructs tools by rotating "metal", punching holes in it, changing its size and other characteristics (rising attributes to make decisions and predict outcomes), they came into the classroom before school one morning. They said to the teacher, "We called each other last night and think we've figured out how to get the machines to make the tool by skipping and changing some of the directions (computer algorithms). We want to try them out and see if we're right."

The microcomputer in the elementary classroom is a thought-enhancer when the teacher and administrator choose a course of action for the "right" reasons rather than by default ("Look, the Board says we've got to get computers and software into kid's hands. Buy these packages."). It is important to recognize that, primarily, the computer is not intervention; it is used to liberate and elaborate (Turkle, 1984). It is hoped that the pressure of "change" that many schools are faced will not lend to more bad decisions about purchasing and using microcomputers (Wilson, 1984).

Recently, a Central Office Administrator, interested to determine whether computers were being used appropriately, asked an elementary principal to walk with her through the building to observe instances of computer use. They could find none of the many comouters in use at that time. There was a concern voiced that the computers were gathering dust. There was also the opposite conclusion that, in this case, disuse was a good sign: teachers did not feel compelled to use the computers simply because it was there, it was expensive and it was trendy.

Upon questioning individual teachers, the most common response was, "Oh, yes, we're using it later when I can sit down and work together with the children". Teachers were models of thinking persons (Furth and Wachs, 1974).

Computers should be used for specific reasons. Appropriate should be seen as a metaphor for emerging "good" teaching methodologies and adaptation of class content. Since they are devices that should be intended to empower the independent risk or initiative takers. When a teacher begins to learn to use new programs in his/her classroom, (s)he reveals self as learner. Children have the opportunity to participate with the adult as learner (not only as teacher). They can, collectively and collaboratively solve problems, engage strategies, generate rules, adapt programs and use the disks in ways in which the programmer didn't intend. The teacher, usually new to computer use, has the opportunity to risk being seen as a learner, not just as possessor of knowledge. Sitting at a terminal with two children and collectively evolving strategies and multiple approaches/ autonomous rule generation allows the teacher to be a participant. If learning is the model for what adults do in the classroom, then the computer provides a richness of possibilities. There is a unique opportunity implicit in the Student Technology-Teacher relationship (Pea, 1985).

The teacher is essential in the covert, yet intense, structuring of a computer environment that liberates and, perhaps, enhances thinking. In-service experiences should be occurring on a variety of levels. If computers are to be accepted into the teacher's methodological repetoire, then it is imperative that computer use be seen as only a part of a good teacher. Computers are <u>not</u> teacher-remedial, nor should they be intrusive. Computers should be used in classrooms to enhance already-excellent methods. It makes no sense for the good teacher to modify the classroom to fit the computer. This approach is often regarded as the mistake of the 1960's and 70's with ITV; teachers often felt compelled to use the

educational programming. There was even the suggestion that ITV lessons were "better" than teacher generated lessons. Computer use should be internalized, by the teacher and the classroom dynamics, into an already-excellent pedagogy. In essence, appropriate computer usage should be viewed as a methodological hybrid, seen as an important media only when and where it offers significant instructional experiences.

Computers are the reality of the current school-aged child. Their use is subsumed into everyday functioning much in the way that television and air travel are for our age group and space travel may be for future generations. They are here, they are probably unavoidable and they afford many opportunities for enhancing an environment that allows for thinking. Papert, Turkle and others utilize a Piagetian constructivist perspective to define appropriate methodologies and curriculum development. "Organization of knowledge (schema) are subject to change and education should make hypothesis-testers out of students, not fixed reality constructions" (Sigel, 1976). The teacher should be given the opportunity to develop this milieu for critical thinking. Administrators should attend less to the scientific model (input variables A and B and the organism will perform in a predictable manner) and the economic model (teaching is too labor-intensive and the computer will "free-up" teachers and cut costs (cost benefit ratio model)). Instead, teachers should have the time, in-service experience and the security within the system to be pro-active. The following vignette will attempt to illustrate the active inquiry that occurs when teachers feel in control of computers, empowered by emerging expertise.

Teachers adapt disks for uses not intended by the author. An example can be seen in the dialogue occurring during the demonstration of a construction set disk, Just Imagine, at a K-3 faculty meeting. The program has a number of characters, some stationery, some mobile, who can be superimposed over several

scenes (eg.: the desert, a city at night, etc.). The characters can then be programmed to make certain movements. A story can be typed in and it can be made into a moving illustration by the child. It is not uncommon for the novice instructional computer user to view a program considered to be quite advanced by those who are experienced at the computer, as "primitive" because of limited range of motion of characters, obtuse selection of sequence and relative lack of sophistication of the graphics we have become used to in movies such as "Star Wars". When the disk was previewed, teachers attempted to assimilate this new information into existing methods and frames of reference. Aside from the "giddiness" when a colleague has to make choices/value judgments in front of peers, there began to emerge "What would I do with this disk?" strategies.

At first, there was discussion of what was "wrong" with the program. There were concerns of constraints on children by the limitations of choices of action figures, settings and number of lines the disk allowed the child to type in. Also, a concern was the tail wagging the dog: did this disk foster writing in a creative sense or simply a format for the child to "explain" that (s)he had been able to laboriously create from the parameters of the program's range? Does this follow similar text editing formats such as Apple Writer, Bank Street, etc.

The next step that emerged was teacher concern for the child feeling successful. A number of teachers worked on strategies that might be regarded as habilitative or adaptive. A form of advanced organizing began to emerge. Statements which characterize this stage included: "Well, you wouldn't use this disk without an adult being there to mediate", "I don't see this occurring before the child had a chance to work with me on the range of options and a 'storyboard' could be developed", and "I would have two children just try it out and look at the possibilities. They could then make a grid of the options of figures, scenes,

and actions. This could be used for both: a) developing a format for other students (in particular, those who are less facile) and b) as a means to bridge pre-graphing, sequencing attribute, etc., skills." There was agreement that the adult (teacher) be a mediator, that the program use be seen as a task among others in sequence and that a number of intermediate and bridging tasks be adapted. In these illustrations and in a number of other ways, the intent of the programmer is extended and permuted. Advanced issues, (eg.: children thinking out loud, subtle shifts to reinforce and self-correct, etc.) complete the "constructivism" of the aptly-named construction set disk. In a developmental perspective, the teacher doesn't throw the baby out with the bathwater but, instead, adapts and molds the program disk to absorb it into emerging methods and expectations of the already-well-defined curriculum.

I was recently traveling between Chicago and Los Angeles. Seated next to me was an eighteen year old college student who got on at O'Hare. She sat down in a brown dress with a white collar and matching shoes. A transformation occurred during the intervening four and a half hours. First, she went to the restroom and returned in leather pants and an off-the-shoulder sequined sweater. She then began the metamorphasis of her face, nails and hair. Powder blue eye shadow was replaced by streaks of dark orange and red-brown. These lines radiated out an inch from her eyes. Her nails were painted fire red and her hair was manipulated to get the intended effect. As we approached Los Angeles, I had to ask her about the transformation. She said that her parents had put her on the plane at Chicago, but that she had two weeks in Hollywood at her older sister's apartment and that she didn't intend to miss a second. I asked her about her education and she told me that she went to a girl's college and was studying computer education. I thought that, like the parents in Chicago, we may not be aware of the changes

that are occurring in the computer generation (although less startling than the young lady on the plane). It seems important to lead the aggressive integration of the new technology into the total fabric of the school setting (Estes, 1983). We must research the more intensive (deeper) learner characteristics and outcome that relate more to life success than, necessarily, school success. Technology-enhanced education is education and must be adapted to out notions of child development, philosophy, etc. We are the leaders and controllers.

Thomas Daugherty is a principal in the Shoreham-Wading River (New York) Schools and a member of the Cognitive Levels Matching Team, a project designed to use a Piagetian perspective in curricular analysis, teacher methods and student conceptual development, K-12. The author wishes to thank colleague, Esther Fusco, Ph.D. for her support and cooperation in this paper.

TD:mj

Appropriate Computer Use To Empower Thinkers

BIBLIOGRAPHY

1) Komoski, P. Kenneth, "Educational Computing: The Burden of Insuring Quality". Kappan, December, 1984, page 245.

2) Burroughs, R. (ed.). "The Big Shift", Electronic Learning, Volume 4, #8, May/June, 1985.

3) Diem, Richard. "Developing Computer Educational Skills: An In-Service Training Program", Educational Technology, February, 1981, pages 30-32.

4) Papert, S. Mindstorms, 1978.

5) Zajonc, Arthur G. "Computer Pedagogy? Questions Concerning The New Educational Technology". Teacher's College Record, Volume 85, #4, Summary, 1984.

6) Davy, John. "Midstorms in the Limelight". TC Record, Volume 85. #4, Science '84.

7) Turkle, Sherry. The Second Self, (New York: Simon and Schuster, 1984).

8) Wilson, Robin (ed.). Education Computer News. Volume 1, #24, December 5th, 1984, page 2.

9) Furth, Hans and Harry Wachs. Thinking Goes To School. 1974.

10) Pea, R. "Student Learning and Educational Technologies", National Commission On Industrial Innovation, 1984.

11) Estes, Nolan. "The Future Is Now". Impact on Instructional Improvement, Volume 18, #3, Spring, 1983, page 6.